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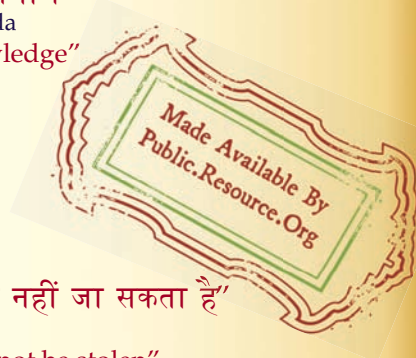
IS 738 (1994): Wrought aluminium alloys, drawn tube for general engineering purposes [MTD 7: Light Metals and their Alloys]



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“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

पिटवाँ एल्युमिनियम और उसकी मिश्रधातुएँ – सामान्य
अभियांत्रिकी प्रयोजनों के लिए कर्षित नलिकाएँ – विशिष्ट

(तीसरा पुनरीक्षण)

Indian Standard

WROUGHT ALUMINIUM AND ITS ALLOYS —
DRAWN TUBES FOR GENERAL ENGINEERING
PURPOSES — SPECIFICATION

(*Third Revision*)

UDC 669.71-462-124

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Light Metals and Their Alloys Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1956 and subsequently revised in 1966 and 1977. The following modifications have been made in this revision:

- a) Old alloy designations have been deleted,
- b) New temper designations have been incorporated (*see* Annex A),
- c) Requirements of alloy 65026 have been added, and
- d) Chemical composition of alloy 65032 has been modified.

Some characteristics and typical uses of the aluminium and its alloys covered in this standard are given in Annex B, for guidance only.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

WROUGHT ALUMINIUM AND ITS ALLOYS — DRAWN TUBES FOR GENERAL ENGINEERING PURPOSES — SPECIFICATION

(*Third Revision*)

1 SCOPE

This standard covers the requirements of wrought aluminium and aluminium alloy drawn tubes of round cross-section for general engineering purposes.

2 REFERENCES

The Indian standards listed in Annex A are necessary adjunct to this standard.

3 TERMINOLOGY

3.1 For the purpose of this standard, the following definition as given in IS 5047 (Part 1) : 1966 and IS 5047 (Part 2) : 1979 shall apply.

3.1.1 Heat Treatment Batch

A quantity of material of one alloy of the same dimensions and produced in the same way, solution-treated and subsequently precipitation-treated in one furnace load. More than one heat-treatment batch may comprise a furnace load.

3.1.2 Tube

A hollow wrought product that is long in relation to its cross-section, which is round; or regular hexagon; or regular octagon; or elliptical; or square; or rectangular with sharp or rounded corners, and that has uniform wall thickness except as affected by corner radii.

3.1.2.1 Drawn tube

A hollow product of uniform wall thickness produced by cold-drawing from tube bloom.

3.1.2.2 Extruded tube

A hollow extrusion of uniform wall thickness not subjected to cold drawing.

3.1.2.3 Welded tube

Tube formed from plate or sheet welding the abutting edges.

3.1.3 Tube Bloom/Tube Shell/Tube Stock

A hollow wrought section of uniform wall thickness used for production of drawn tube.

4 SUPPLY OF MATERIAL

General requirements for the supply of material shall conform to IS 10259 : 1982.

5 CONDITION OF DELIVERY

The material shall be supplied in the condition as ordered by the purchaser according to tempers specified in Table 2. While specifying the condition, the temper designations as given in IS 5052 : 1983 shall be followed.

6 FREEDOM FROM DEFECTS

The drawn tubes shall be sound and free from harmful defects.

7 DIMENSIONS AND TOLERANCES

The dimensions of drawn tubes and their tolerances shall be as given in IS 2678 : 1987.

8 CHEMICAL COMPOSITION

8.1 The chemical composition of drawn tubes shall conform to the requirements given in Table 1.

8.2 The chemical composition shall be determined by the methods specified in IS 504 : 1963 or IS 11085 : 1984 or any other established instrumental/chemical method. In case of dispute, the procedure specified in IS 504 : 1963 shall be the referee method.

9 MECHANICAL PROPERTIES

9.1 The mechanical properties of the drawn tubes shall conform to the requirements given in Table 2.

9.1.1 Tensile Test

The tensile test shall be carried out in accordance with IS 2657 : 1964 on the test pieces prepared from the samples selected as per the procedure specified in 9.2.

Table 1 Chemical Composition of Wrought Aluminium and Aluminium Alloys for Drawn Tubes for General Engineering Purposes

(Clause 8.1)

(Composition limits are in percent maximum unless shown otherwise)										
Designation	Aluminium	Copper	Magnesium	Silicon	Iron	Manganese	Zinc	Titanium ¹⁾	Chromium	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1 9000	99.0 <i>Min</i>	0.1	—	0.5	0.6	0.1	—	—	—	Ti + V = 0.07 T. I. ²⁾ = 1.00
1 9500	99.5 <i>Min</i>	0.05	—	0.3	0.4	0.05	—	—	—	Ti + V = 0.07 T. I. ²⁾ = 0.50
24 345	Remainder	3.8-5.0	0.2-0.8	0.5-1.2	0.7	0.3-1.2	0.2	0.3	0.3	Ti + Cr = 0.3
31 000	Remainder	0.1	0.1	0.6	0.7	0.8-1.5	0.2	0.2	0.2	—
52 000	Remainder	0.1	1.7-2.6	0.6	0.5	0.5	0.2	0.2	0.25	Cr + Mn = 0.5
63 400	Remainder	0.1	0.4-0.9	0.3-0.7	0.6	0.3	0.2	0.2	0.1	—
64 430	Remainder	0.1	0.4-1.2	0.6-1.3	0.6	0.4-1.0	0.1	0.2	0.25	—
65 028	Remainder	0.15-0.4	0.7-1.2	0.4-0.8	0.6	0.2	0.2	0.2	0.15-0.35	—
65 032	Remainder	0.15-0.4	0.7-1.2	0.4-0.8	0.6	0.2-0.8	0.2	0.2	0.2	—

¹⁾ Titanium also includes other grain refining elements, if any.²⁾ T. I. = Total impurities.

NOTE — It is the responsibility of the supplier to ensure that any element not specifically limited is not present in an amount such as is generally accepted as having an adverse effect on the product. If the purchaser's requirements necessitate limits for any element not specified, the same should be agreed to between the supplier and the purchaser.

Table 2 Mechanical Properties of Aluminium Alloy Drawn Tubes for General Engineering Purposes

(Clause 9.1)

Designation	Condition	Size (Wall Thickness)		0.2 Percent Proof Stress		Tensile Strength		Elongation on Gauge Length of 50 mm
		Over	Up to and Including					
		mm	mm	Min MPa	Min MPa	Max MPa	Min	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
19 000	0	—	12.0	—	—	105	—	
	H×8	—	12.0	—	120	—	—	
19 500	0	—	12.0	—	—	95	—	
	H×8	—	12.0	—	110	—	—	
24 345	T4 ¹⁾	—	10.0	290	395	—	8	
31 000	0	—	10.0	35	—	110	24	
	H×4	—	10.0	120	140	—	5	
52 000	0	—	10.0	—	—	200	18	
	H×4	—	10.0	170	225	—	5	
63 400	0	—	10.0	—	—	155	—	
	T4	—	10.0	95	150	—	15	
	T6	—	10.0	170	200	—	8	
64 438	T4	—	10.0	110	215	—	12	
	T6	—	6.0	245	310	—	7	
		6.0	10.0	230	310	—	9	
65 028	T4	—	6.0	110	215	—	12	
		6.0	10.0	110	215	—	14	
	T6	—	6.0	230	295	—	7	
		6.0	10.0	215	295	—	9	
65 032	T4	—	6.0	110	215	—	12	
		6.0	10.0	110	215	—	14	
	T6	—	6.0	230	295	—	7	
		6.0	10.0	215	295	—	9	

NOTE — 1 MPa = 1 N/mm² = 0.102 kgf/mm².

¹⁾ If the user reheat-treats this material, the minimum 0.2 percent proof stress and tensile strength may be reduced to 230 MPa and 385 MPa respectively. Similar properties may also be obtained when tubes are supplied in the annealed condition and subsequently heat-treated.

9.1.2 *Flattening Test*

The flattening test shall be carried out in accordance with IS 2328 : 1985. A test piece not less than 50 mm long cut from each selected tube shall be flattened until the interior surfaces of the tube meet.

9.2 *Selection of Test Samples*

9.2.1 *Aluminium or Non-Heat-Treatable Aluminium Alloys*

9.2.1.1 The tubes of the same dimensions, produced in the same way and of the same alloy shall be grouped in lots weighing up to 1 000 kg. One test sample shall be cut from a tube selected from each lot.

9.2.1.2 Before any of the test samples are cut off, they shall be marked to identify them with the lot they represent.

9.2.1.3 The test samples shall be taken from the tubes as supplied and shall not be annealed or mechanically worked (except for straightening and machining to the shape of the test piece) before they are tested.

9.2.1 *Heat-Treatable Aluminium Alloys*

9.2.1.2 One test sample shall be cut from a tube selected from each heat treatment batch.

9.2.1.3 Before any of the test samples are cut off, they shall be marked to identify them with the heat-treatment batch they represent.

9.2.1.4 The tubes supplied in the P or O condition, the test samples shall be heat-treated and tested in the T4 or T6 condition, as specified by the purchaser. The test samples, after heat-treatment shall not be mechanically worked (except for straightening and machining to the shape of the test piece) before they are tested.

9.2.1.5 The tubes supplied in the T4 condition may be expected to develop the mechanical properties of the T6 condition on appropriate heat treatment.

9.2.1.6 The tubes supplied in T4 condition the test samples shall be tested in the condition as supplied, unless the purchaser has specified that he requires the test sample to be tested in

the T6 condition. The test samples shall not be mechanically worked (except for straightening and machining to the shape of the test piece) before they are tested.

9.3 *Retest*

9.3.1 Should any one of test pieces first selected fail to conform to the mechanical tests, two further samples from the same lot/heat-treatment batch shall be selected for testing, one of which shall be from the tube from which the original test samples was taken unless that tube has been withdrawn by the supplier.

9.3.1.1 For heat-treatable alloys the supplier shall have the right, if he so desires, to reheat-treat the tubes before two further samples are selected.

9.3.2 Should the test pieces from both these additional samples conform to the specified values, the lot/heat-treatment batch represented by the test samples shall be deemed to comply with the requirements of mechanical properties.

10 *MARKING*

10.1 Tubes shall be suitably marked for identification, with the following details:

- a) Lot or heat-treatment batch number;
- b) Alloy and temper designations; and
- c) Indication of the source of manufacture.

10.2 *BIS Certification Marking*

The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

11 *TEST CERTIFICATE*

The manufacturer/supplier should supply test certificate along with each consignment giving information like lot number, corresponding chemical composition and mechanical test results.

ANNEX A

(Foreword)

COMPARISON OF IS TEMPERS WITH ISO TEMPERS (see IS 5052 : 1993)

Old IS Tempers	New ISO Tempers	ISO Tempers	Old IS Tempers	New IS Tempers	ISO Tempers
—	M	M	WD	T3	TD
M	F	F	W	T4	TB
O	O	O	P	T5	TE
H	H	H	WP	T6	TF
H1	H × 2	H × B	WS	T7	TM
H2	H × 4	H × D	WDP	T8	TH
H3	H × 6	H × F	WPD	T9	TL
H4	H × 8	H × H	—	T10	TG
—	T1	TA	PD	—	—
—	T2	TC	WR	—	—

ANNEX B

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	Title	IS No.	Title
504 : 1963	Method of chemical analysis of aluminium and its alloys (<i>revised</i>)	5047 (Part 2) : 1979	Glossary of terms relating to aluminium and aluminium alloys : Part 2 Plant and operations, thermal treatment, control and testing, finishing
2328 : 1985	Method for flattening test on metallic tubes (<i>first revision</i>)		
2657 : 1964	Method for tensile testing of aluminium and aluminium alloy tubes	5052 : 1993	Aluminium and its alloys — Temper designations
2678 : 1987	Dimensions and tolerances for wrought aluminium and aluminium alloy round tubes (<i>second revision</i>)	10259 : 1982	General conditions for delivery and inspection of aluminium and aluminium alloy products
5047 (Part 1) : 1986	Glossary of terms relating to aluminium and aluminium alloys : Part 1 Unwrought and wrought metals (<i>second revision</i>)	11085 : 1984	Spectrographic analysis of wrought aluminium alloys

ANNEX C

(Foreword)

CHARACTERISTICS AND TYPICAL USES OF ALUMINIUM AND ALUMINIUM ALLOYS

Designation	Characteristics	Available Forms	Typical Uses
(1)	(2)	(3)	(4)
19000	Commercially pure aluminium, very ductile in annealed or extruded condition, excellent resistant to corrosion	Sheet, plate, extruded tube, wire, forgings	Paneling and moulding, equipments for food, chemical and brewing industries, architectural and builders hardwares, fastners, welding wires and electrical appliances, refrigeration tubes and wave guide tubes
19500	High purity aluminium, more resistant to corrosion than other grades	Sheet, plate, extrusion, tube, wire, rolled rod and forgings	Food, chemical, brewing and processing equipments, marine fittings, pressed and anodized utility items, heat exchanger tubes, condenser tubes, gas and oil transmission pipeline
24345	Strong alloy that is aged naturally at room temperature after solution treatment and has fair ductility in this condition	Sheet, plate, extrusion tube, wire and forgings	Stressed parts in aircraft and other structures where high strength is of primary consideration, hydraulic tubes
31000	Stronger and harder than 19000 but has good workability, weldability and corrosion resistance	Sheet, plate, extrusion, wire, tube, rolled rods and forgings	General purposes alloy for moderate strength applications, pressure vessels, irrigation tubing, heat exchangers, utensils and pressure cookers, roofing sheets, pilfer proof and detonator caps, air-conditioning ducting fan blades and vehicle paneling
52000	Ductile in soft condition, but work hardens rapidly becoming exteremely tough. Has high resistance to corrosion in marine atmosphere	Sheet, plate, extrusion tube, wire, and forgings	Paneling and structures, hydraulic tube appliances, refrigeration tubing condenser and heat exchanger tubes gas and oil transmission pipelines
63400	Suitable for intricate extruded sections of medium strength, forms in W condition, highly resistance to corrosion	Extrusion, wire, tube rolled rod and forgings	Architectural uses and other similar applications where surface finish is important and medium strength would suffice. Electrical conduits, tubes for wave guides, gas and oil transmission pipelines

Designation (1)	Characteristics (2)	Available Forms (3)	Typical Uses (4)
64430	A medium-strength alloy with good mechanical properties, corrosion resistance and weldability	Sheet, plate, extrusion, tube, wire and forgings	Structural applications of all kinds, such as road and rail transport vehicles, bridges, cranes, roof trusses, rivets, etc. Cargo containers, milk containers, deep drawn containers and flooring
65028	Medium strength alloy with good mechanical properties and corrosion resistance	Extrusion, wire, tube forgings and rolled	Structural applications of all kinds such road and rail transport vehicles, bridges, cranes, roof trusses, furniture, gas and oil transmission pipe lines, condenser and heat exchanger tubes, hydraulic tubes
65032	Similar to 65028	Similar to 65028	Similar to 65028

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